

the South African fauna, and offers excellent suggestions for the purpose, he is nevertheless somewhat in the position of Satan reproving sin. He appears to have spared but little in the way of buffaloes, antelopes, zebras, or hippopotami that came in his way, and his beautiful photographs—over and over again—of his trophies make one wince at the shocking and needless, extirpation of creatures more wonderful or beautiful, in their physical aspect, than their destroyer. A typical instance of this may be seen in the illustration on p. 227, and it must be borne in mind that this collection of trophies refers to the already sorely diminished game of Zululand.

An interesting chapter contributed to the book by Mr. Cronwright Schreiner deals with the marvellous migrations of the springbuck, which until recently used to pour down at intervals from the northern regions (Bechuanaland and Transvaal) over the more settled districts of South Africa. These movements, Mr. Schreiner thinks, are due to drought in the hinterland forcing the springbuck to move in enormous numbers in search of fresh pasture. Mr. Schreiner himself computes the number that he saw in 1896 in one of these extraordinary migrations at 500,000. An excellent photograph is given of these migratory springbuck on the trek. Of course, on these occasions, the creatures were so massed together that flight from human beings, leopards, or lions was impossible. There have even been occasions when men on foot, overtaken by one of these surging crowds of antelopes, have been knocked down and trampled to death. Mr. Findlay puts in a very strong and valid plea for a gigantic zoological gardens to be created by the State at Pretoria, taking advantage of its genial climate, its abundant water supply, and the fact that so much of the local vegetation is of a semi-tropical character.

The book under review is well worth reading, and will be of permanent value as recording some excellent pictures of the South African buffalo, a form which, owing to the ravages of rinderpest and the attacks of sportsmen, is not very far off extinction.

H. H. JOHNSTON.

ENGINEERING SCIENCE.

Engineering Standards Committee. No. 3. Report on the Influence of Gauge, Length and Section of Test Bar on the Percentage of Elongation. By Prof. W. C. Unwin, F.R.S. Pp. 21, and 2 diagrams. (London: Crosby Lockwood and Son.) Price 2s. 6d. net.

Technical Mechanics. By Prof. E. R. Maurer. Pp. xvi+382. (New York: John Wiley and Sons; London: Chapman and Hall, Ltd., 1903.) Price 7s. net.

THE first of the volumes under notice is one of the reports published by the Engineering Standards Committee, which is doing such valuable work at the present time, and deals with the very important question of the proper dimensions for test bars in order that the percentages of elongation in different sets of experiments can be compared with one another. The report is written by Prof. Unwin, F.R.S., who carried

out a series of original investigations for the committee in order that they might have definite experimental data before coming to any decision as to the proportions they would recommend for test bars.

A brief historical summary of our knowledge on this question from the first enunciation of Barba's law in 1880 up to the present is first given, and then the author describes in detail his own series of experiments on ship and boiler steel plates. In the body of the report are given summary tables of the results obtained, and in the appendices full details of the various tests, while the results are shown graphically in the diagrams appended to the report. It was clearly shown by one series of the tests that serious errors are introduced in comparing the ductility of bars when the width of the cross section is kept constant, and therefore the cross sectional area is allowed to vary.

In discussing the rules which might be laid down for standard sizes of test bars, the author points out the grave practical difficulties which arise in either varying the gauge length so as to keep the ratio l/\sqrt{a} constant, or in keeping both gauge length and cross sectional area constant. He suggests that the best plan, from a scientific point of view, would be to keep to a gauge length of 8 inches, and a cross sectional area not exceeding 1 square inch for all plates from $\frac{3}{8}$ inch to $\frac{7}{8}$ inch in thickness, such plates constituting the great bulk of those tested for commercial purposes. As an alternative it might be advisable to specify a fixed gauge length of 8 inches and a width of test bar not to exceed 2 inches for plates lying between $\frac{3}{8}$ inch and $\frac{7}{8}$ inch in thickness, and then to draw up special rules for plates lying outside these limits of thickness. The author, it might be pointed out, has lately given a much more complete account of this piece of research work in a paper read before the Institution of Civil Engineers on November 10 last.

If the various reports of the Standard Committee are all carried out on the lines of those issued up to the present, they will prove of the utmost value to engineers and to the engineering trade of the country.

Prof. Maurer's volume is a text-book on theoretical mechanics for engineering students, the subjects treated having in all cases a direct bearing on engineering problems. It is divided into three sections—statics, kinematics, and kinetics—treated in the order in which they are given.

In dealing with statics, the author adopts freely both graphical and analytical methods, and we strongly approve of this plan, as it has always appeared to us most unwise to divorce these two methods of treatment of statical problems; if properly handled together they greatly assist the beginner in overcoming some of the notorious stumbling-blocks in this branch of mechanics. A particularly useful chapter in this section, both for teacher and student, is vi., in which a series of practical problems involving the application of the principles of equilibrium (worked out in earlier chapters) are dealt with both graphically and algebraically; the examples cover such cases as flexible cords in tackles, jointed frames; and friction in screws, pin joints, belts, &c.

Kinematics is treated mainly from the point of view

of its application in the third section on kinetics, but special attention is devoted to harmonic motion, a matter of great importance to engineers engaged in the design of valve gears, and the investigation of the valve motion due to any type of gear. In the introductory chapter to kinetics, the author discusses fully the difficulties due to the two systems of units adopted in dealing with "mass"; he realises that the gravitation system, or so-called "engineer's system," is not likely to be displaced in spite of the constant endeavours of reformers; it is, in fact, too convenient and enters too constantly into the ordinary engineer's everyday work to be lightly given up. He suggests a name for it—the gee-pound or the gee-kilogram—but we are afraid such names are never likely to be adopted generally; the present method of explaining it as the "engineer" unit is sufficient for all practical purposes, and the names suggested seem to us only to add to the existing confusion. This section is an exceedingly good one; the practical applications are well chosen, such as inertia of reciprocating parts in engines, vibration of springs, moments of inertia of solids of revolution, governors, balancing of rotating bodies, friction of pivots, &c.

In a series of appendices the author treats briefly of vectors, rates, dimensions of units and second moments of areas. The book will be useful to the private student of engineering who is striving to get clear ideas of the fundamental principles on which so much of his work is based, and will probably be adopted in many technical colleges as one of the standard text-books on mechanics.

T. H. B.

THE GROWTH OF A FEDERAL EMPIRE.

Geographic Influences in American History. By Albert Perry Brigham, A.M., F.G.S.A., Professor of Geology in Colgate University. Pp. xii + 366. (Boston, U.S.A., and London: Ginn and Co., 1903.) Price 6s.

PROF. BRIGHAM, already known to geologists by a concise and clearly written text-book, here makes an appeal to the historian and the geographer. He does not start with generalisations as to the arrival of the first men on the American continent, or as to its situation between the two ends of the Old World; but he brings us at once to the adventures of Columbus, of Cartier, and then of the English settlers, who found Spaniards south of them and Frenchmen to the north, and who thereupon colonised the central seaboard. "America," in this compact treatise, is wisely limited to the United States, with so much of Canada as is inevitably mingled with their history. The style is direct and even vigorous; in Prof. Brigham's crisp sentences there is a continual mental stimulus, and it would be hard to find a redundant word. We do not like the poetry that is quoted in the book, for the benefit of the general reader, half so much as the author's own admirable prose.

The rise of New York is traced to the formation of the Erie Canal in 1825, whereby the grain of the central plains was brought through the Mohawk gap

and floated down the Hudson. The Appalachians have long proved hard to traverse further south, the railways, some of them quite recent, crossing the range at heights of about two thousand feet. The story of the decay of agriculture in New England (p. 47) throws a somewhat melancholy light on the competition between east and west. The author (p. 64) believes that the decay is temporary, and that much of the farm-land in the east will relapse into beneficial forests. The possibility of a balance of mutual utility between districts one or two thousand miles apart affords a pleasant contrast with our tariff-bound Disunited States of Europe. When, however, Prof. Brigham asserts that North America was meant to be owned by one great nation, we think that he is reasoning backwards from the feelings of the present day. A strong Spanish race might long have held the west, a strong French federal republic might conceivably have occupied the plains, and a chain of custom-houses might have existed in the twentieth century on the rim of the Alleghany plateau. We suffer daily in the Old World from violations of geographical propriety, which far surpass anything that would have arisen from such a partition of America.

Prof. Brigham is, however, always willing to lay a proper stress on human enterprise and human individuality. The eastern States became divided (p. 75) as much by differences of "breeding" and ancestral habit as by geography; and the men whose modes of thought allowed them to work hard with their hands have naturally come best out of the struggle.

We have some suspicion that the author prefers Pittsburg to the blue-grass meadows of Kentucky, even when he pictures so charmingly (p. 102) the primitive backwoodsmen, brought up amid a "stable environment in a remote region." After all, the development of machinery has been the making of American agriculture, and it may be difficult, in such a country, to perceive that the growth of cities beyond a certain size and standard is as inimical to social development as is actual isolation in the fields. In the Old World we have so many interests, unconcerned with material prosperity, that we view the growth of Glasgow or Duluth (p. 137) with concern rather than exultation. There is plenty of romance, however, in the story of the capture of the French area on the Mississippi (p. 147) from its English overlords, and abundant cause for national fervour in the map given opposite p. 314, showing the progressive expansion of the United States. The most striking feature, perhaps, in this graphic epitome is the extent of the Louisiana territory, obtained by purchase from Spain in 1803, and stretching west from the Mississippi to the head-waters of the Missouri.

"The West," says Prof. Brigham (p. 308), "is the cosmopolitan part of America. A thousand miles is a short excursion, and across the continent is not an undertaking. Men who could not change their horizon without homesickness did not go west; they are independent of distance, they are accustomed to looking up to find their mountains, and their children are born into their wide, free life."

After remarking that the Pacific coast will "in coming days be commercially independent of the